



**QHYCCD**

USB3.0 high-speed camera

# QHY5III Series

User's Manual REV.1.2



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## 01 Software Installation

1. Download and install [ASCOM platform](#)

2. Download and install [Camera Driver](#)

Note that QHY5III series cameras use the same drivers, so you can download their drivers from any webpage of cameras belonging to QHY5III series.

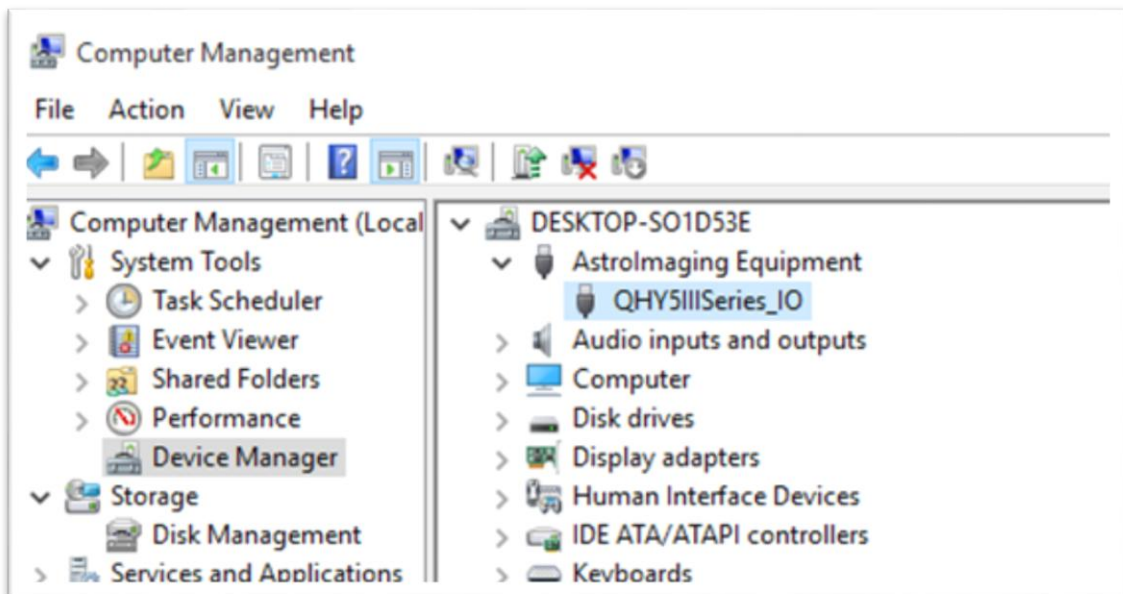
3. Download and install [ASCOM Driver](#)

As you most probably want to use your cameras as an expose camera, please download the Capture version. If you want to use it as a guide camera, please download the Guide version.

4. QHY5III series cameras use SharpCap as the default capture software. Please download [SharpCap](#). QHY5III series cameras can run on SharpCap 2.7 or later versions

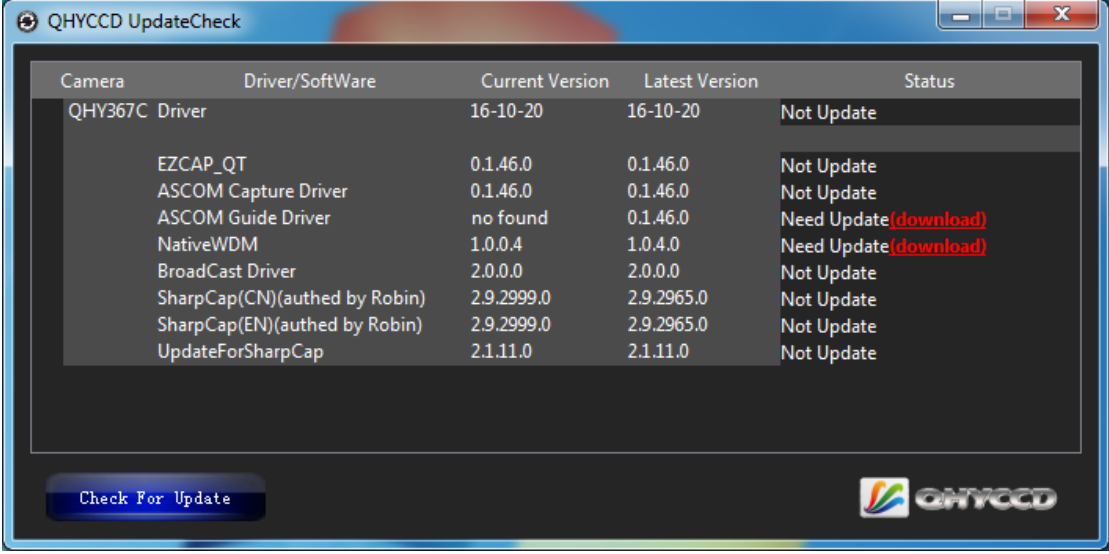
Note that QHY5III series cameras requires the latest qhyccd.dll for the new version of SharpCap, and QHYCCD has already made [SharpCap Patch](#) for it. You should download and install it prior to using SharpCap.

5. Connect QHY5III series cameras to your PC with USB3.0 cable. For the first time the system will find a new device and search the driver. You can skip the online searching by clicking “Skip obtaining driver software from Windows Update” and the computer will find the drivers. After installation is complete successfully, you can find the device in the device manager as shown in the picture below



QHYCCD has developed a software named [UpdateCheck](#) that can check if the drivers installed on your computer are the latest versions as well as update the drivers if needed. If the status of some driver is “Need Update”, you can directly download its update package in this software freeing you from the inconvenience of looking for and downloading it from our website.

Take QHY367C (It's only an example, and QHY367C doesn't belong to QHY5III series) for example, you can see the drivers we need are the latest versions and don't need to be updated as shown in the following picture.



The screenshot shows the QHYCCD UpdateCheck application window. It contains a table with the following data:

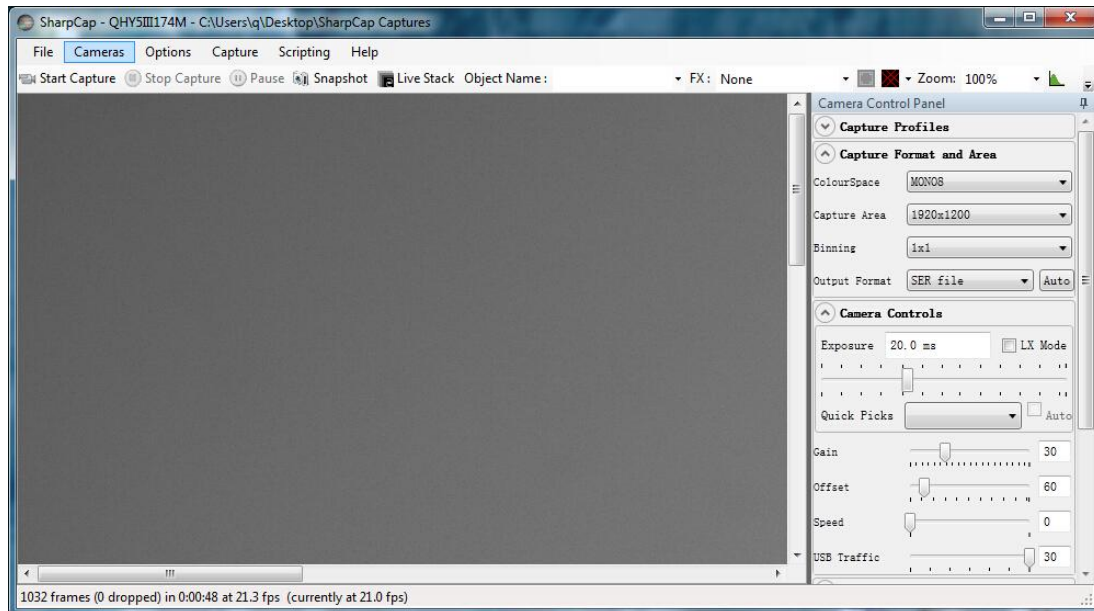
Camera	Driver/SoftWare	Current Version	Latest Version	Status
QHY367C	Driver	16-10-20	16-10-20	Not Update
	EZCAP_QT	0.1.46.0	0.1.46.0	Not Update
	ASCOM Capture Driver	0.1.46.0	0.1.46.0	Not Update
	ASCOM Guide Driver	no found	0.1.46.0	Need Update(download)
	NativeWDM	1.0.0.4	1.0.4.0	Need Update(download)
	BroadCast Driver	2.0.0.0	2.0.0.0	Not Update
	SharpCap(CN)(authed by Robin)	2.9.2999.0	2.9.2965.0	Not Update
	SharpCap(EN)(authed by Robin)	2.9.2999.0	2.9.2965.0	Not Update
	UpdateForSharpCap	2.1.11.0	2.1.11.0	Not Update

At the bottom of the window, there is a "Check For Update" button and the QHYCCD logo.

Note that after you downloading and installing the new drivers by using this software, be sure to pull the USB cable out and then plug it in to enable the new drivers.

## 02 Use QHY5III in SharpCap

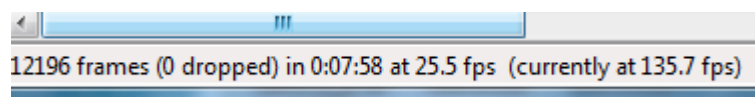
1. Connect camera
2. Run SharpCap. If everything ok, the video image will appear automatically and you will see a FPS number



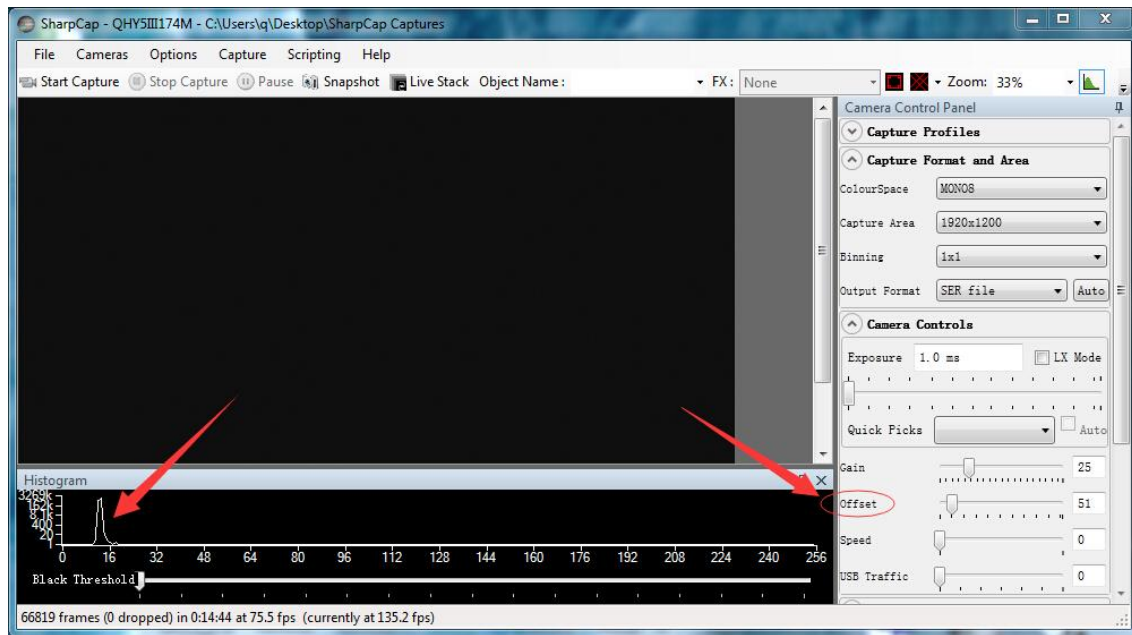
3. If you run the SharpCap earlier than connect camera. You can use menu->cameras->rescan for cameras to search the camera and check on the camera name (eg.QHY5III174).

4. To make sure the camera running the software will start the camera at lowest speed. So you may see the frame rate is much slower than the highest frame rate that declared on QHY5III webpage. Now you can try to increase the performance. First you can try to set the exposure time to 1ms. Then try to reduce the "USB Traffic" value. For modern computer like the i7-4core. It should get max performance. But please note not all computer can get best performance. The CPU loading, the save-energy setting, the mainboard performance and USB3.0 port performance may effect it. Sometimes the display performance will also effect it. So you can try to use "zoom" function to reduce the display size and see if it will help.

The QHY5III174 maximum frame rate at full resolution is about 138FPS. The QHY5III224 is 150FPS, QHY5III290 is 135FPS and the QHY5III178 is 50FPS.



5. Adjust the offset. You may find the when block the light the image is not really zero. Sometimes this will cause the image contrast is not so "good". You can adjust the offset to get a better background. You can open the histogram to confirm it.

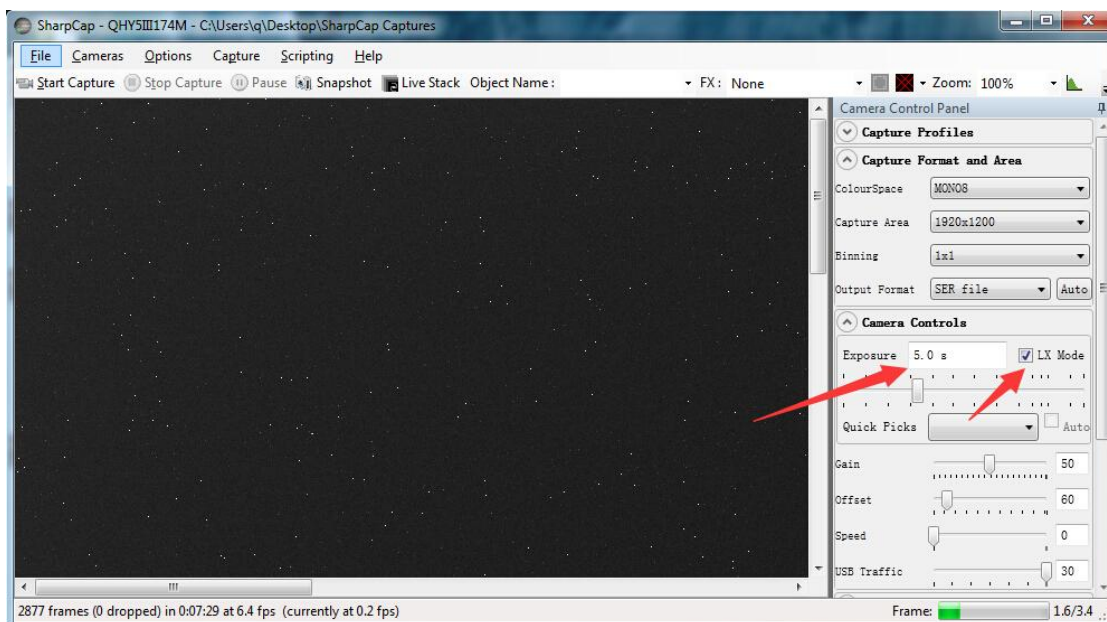


If you are using the color camera, like QHY5III290C, QHY5III224C, QHY5III178C, QHY5III174C, it is very important to set the offset to a low value and let the histogram peak is close to zero. Because the color camera color balance is multiple a ratio to the pixel value in the FPGA. The bias will be multiple also and it may affect the color balance.

6. If you want to try the 16bit image. It is best to set the USB Traffic  $\geq 5$  (For QHY5III174). Otherwise the USB transfer may hang because the data bandwidth is exceed the capability. Then switch the Color space to "mono16"

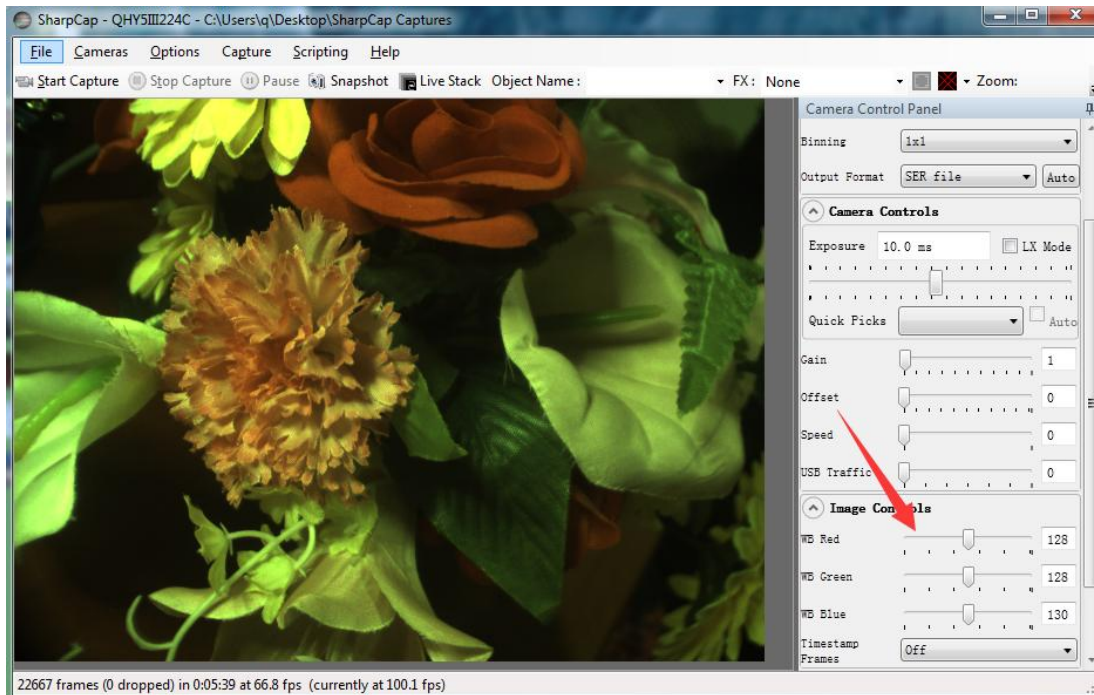
7. By check the "LX" mode you can expand the exposure setting range and do long exposure time. QHY5III series camera has the anti-amp light control circuit and it can reduce the amplifier glow significantly, especially for the IMX174, IMX224.

A typical long exposure image in +25C, 5sec exposure and 50% gain of QHY5III174M



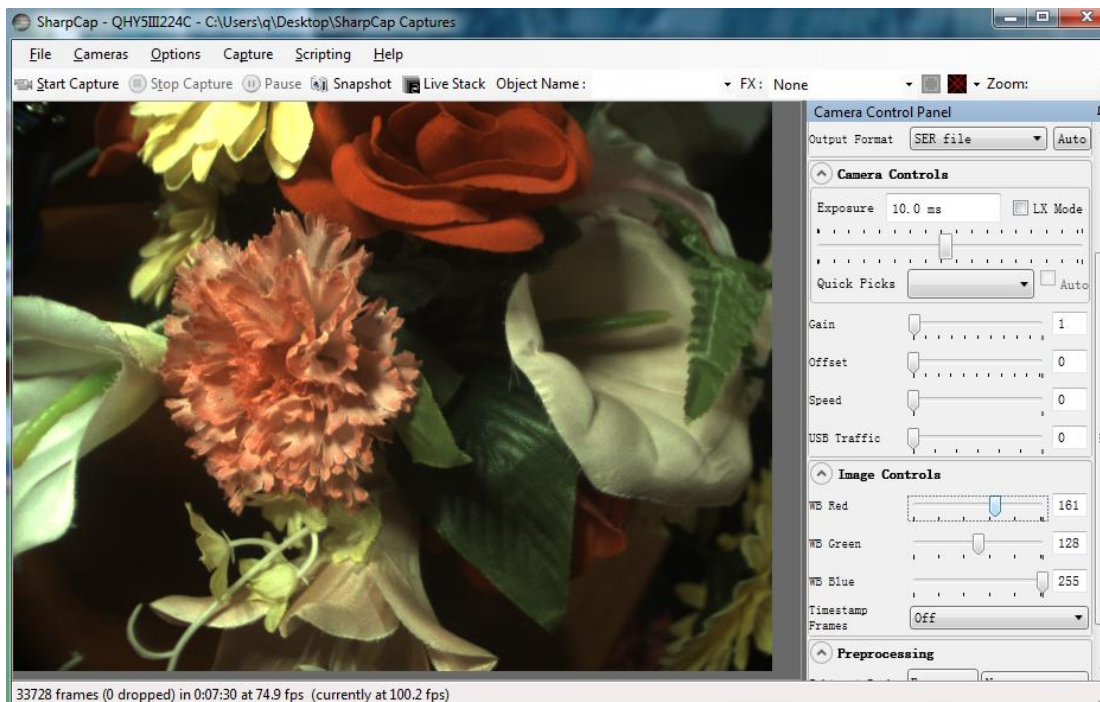
### 03 Color Balance for Color QHY5III Camera

SharpCap will start at the default RGB balance for color camera. Here is the screenshot of the QHY5III224C start up



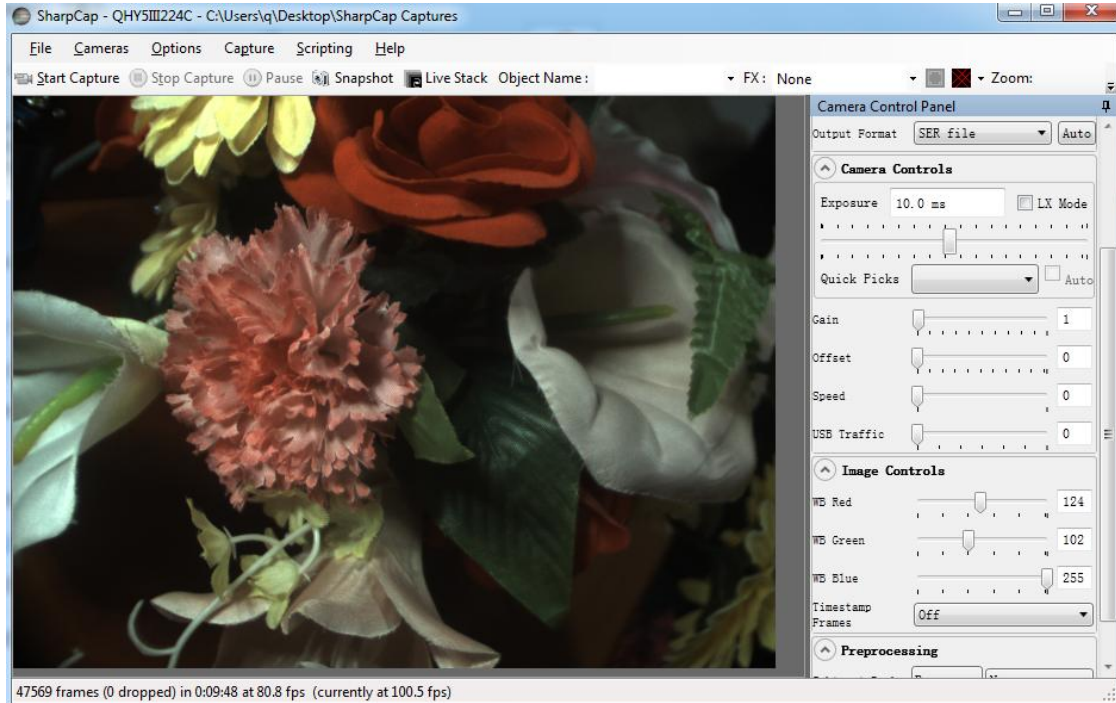
For color camera. SharpCap will show the WB Red/Green/Blue progress bar.

Since the color balance is the ratio between Red to Green and the Blue to Green. You can keep the Green color to 128 and adjust the red and blue.





For example, in this image the blue is 255 and red is 161, green is 128. It looks the color is well white balanced. If you need more blue, since it has reach to 255 and you can not get more. In this condition, you can reduce the green a little and you will have more room for the ratio.



As we said before. If you are doing planetary imaging you should set the offset value as low as possible. To make the background close to zero. Then you can easy to get correct color balance. Otherwise it will not easy to get it. The following image shows the offset is good and you can not get good balance.

The reason is that the Color balance is a ratio of the RGB sensitivity difference. So we use a ratio to multiple the RGB value and get it done. But if there is a bias exist. The ratio will not be correct. For example, the G sensitivity is two times than R.

$G=2R$  In order to get white balance. We multiply a ratio of 2 to R

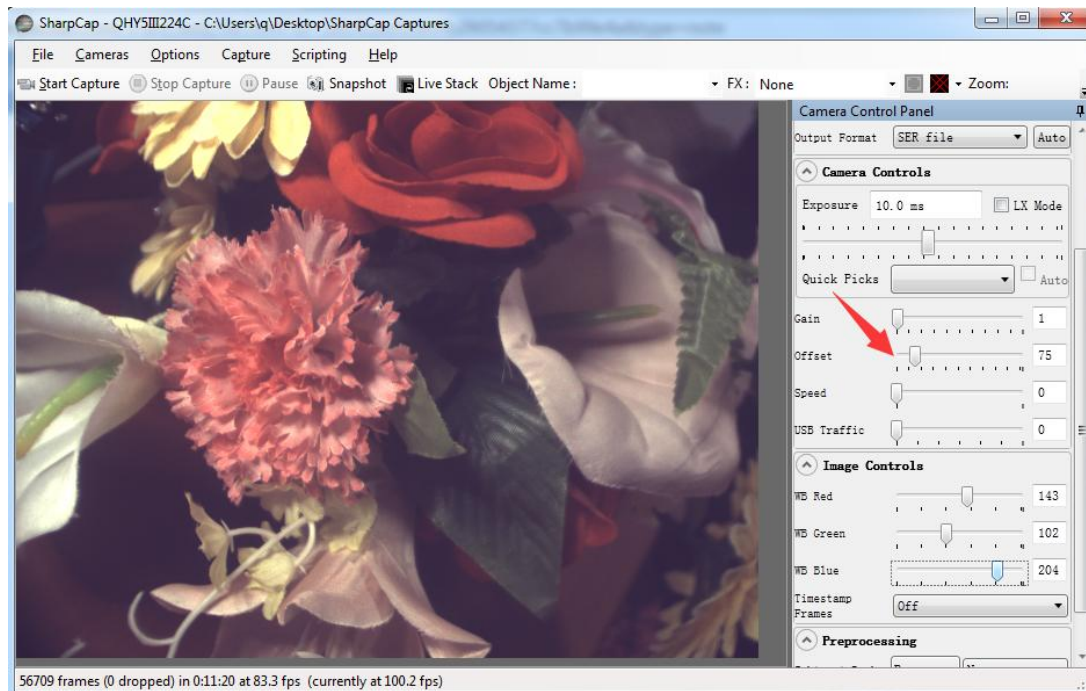
$$R'=2R= G \text{ so we get } R=G$$

When a bias exist. The bias is a constant add to each pixel. So the image you see is:

$$R''=R+bias$$

$$G''=G+bias=2R+bias$$

Now the ratio  $R'':G''=(R+bias)/(2R+bias)$  and it is not equ to 1:2 . It shows the bias will effect the true value of the R:G. And the ratio of R:G will arious when the image light changed. It is hardly to correct with a fixed ratio.



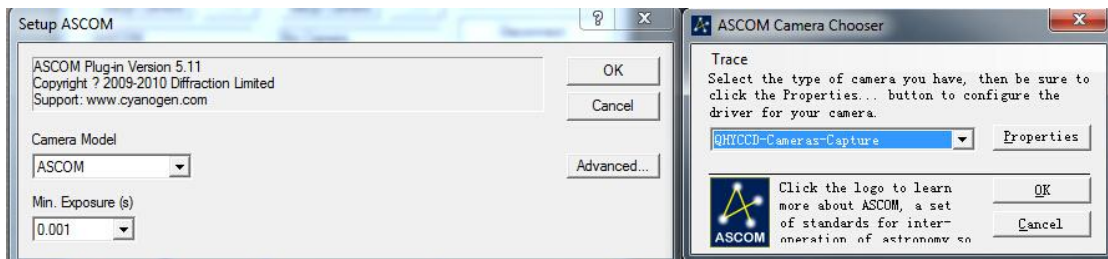
But for DSO capture, You should keep the offset above zero and avoid the background is cut off. A background from 1000-5000 is a good value(16bit mode) for DSO imaging.

## 04 Use QHY5III with ASCOM

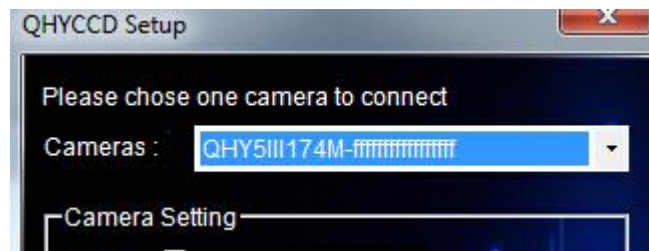
You can connect many software which support ASCOM. Currently QHY5III only support normal ASCOM connection. Does not support the ASCOM VIDEO connection. Please note QHY5III always transfer maximum bit depth (QHY5III174, 224, 290, 185 is 12bit and QHY5III178 is 14bit) by ASCOM to make the best DSO imaging performance. The image format is 16bit bit width and patch zero on low bit.

### MAXIMDL

1. Download and Install ASCOM platform from <http://www.ascom-standards.org/>
2. Make sure the QHY5III ASCOM driver is installed. If not please install it
3. Run MAXIMDL
4. In camera model select list, select ASCOM and then select QHYCCD-Cameras-Capture



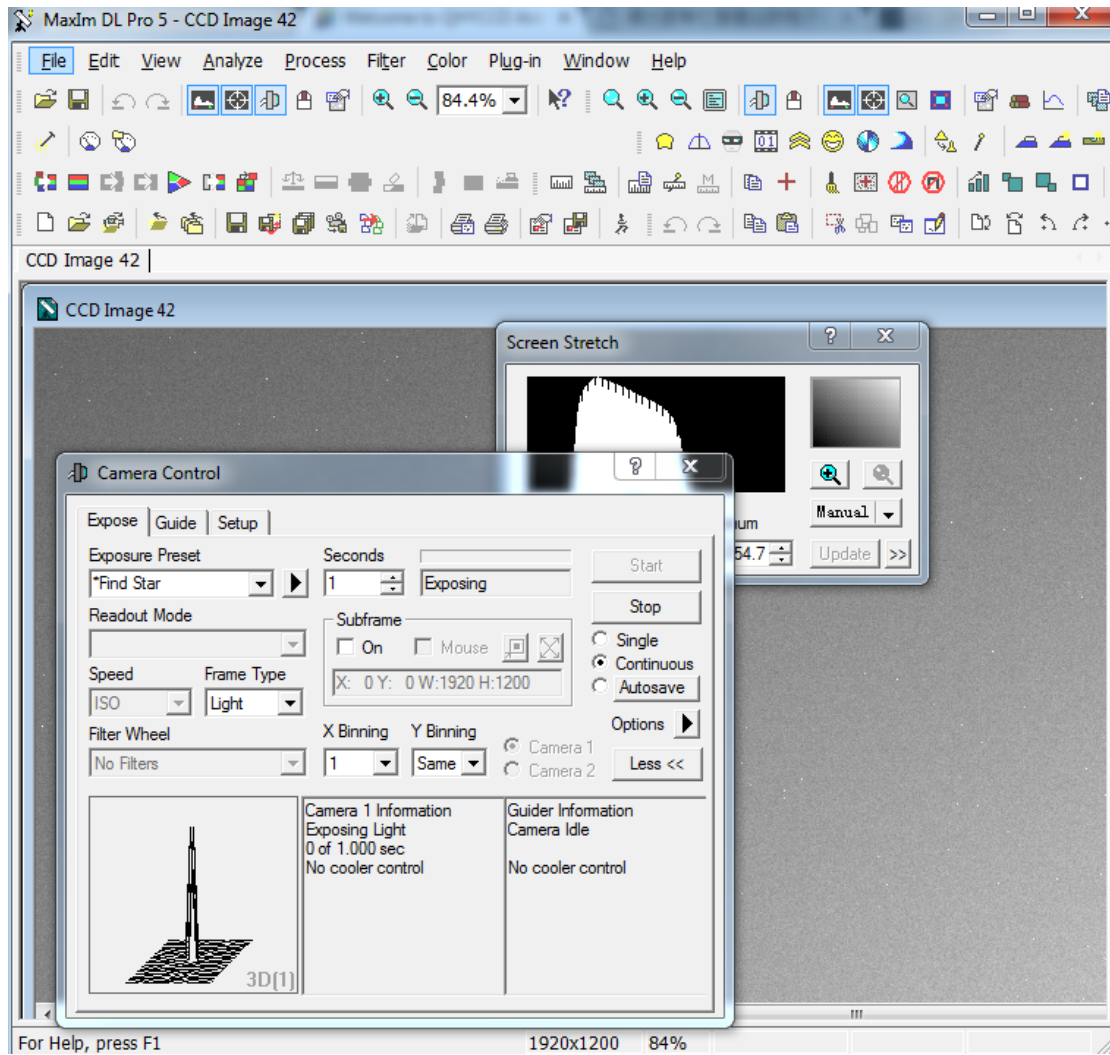
5. In properties, select QHY5IIIxxx Camera



6. Normally, you can set the gain=1 and offset=10 to start. The speed and overscan calibration options are no using in QHY5III camera.

This is a screen shot that QHY5III174M running in MAXIMDL. Since the QHY5III has no large on-camera frame buffer. In a small chance you may meet the frame drop. In this condition, you need wait a longer time than the expected exposure time to get a frame.

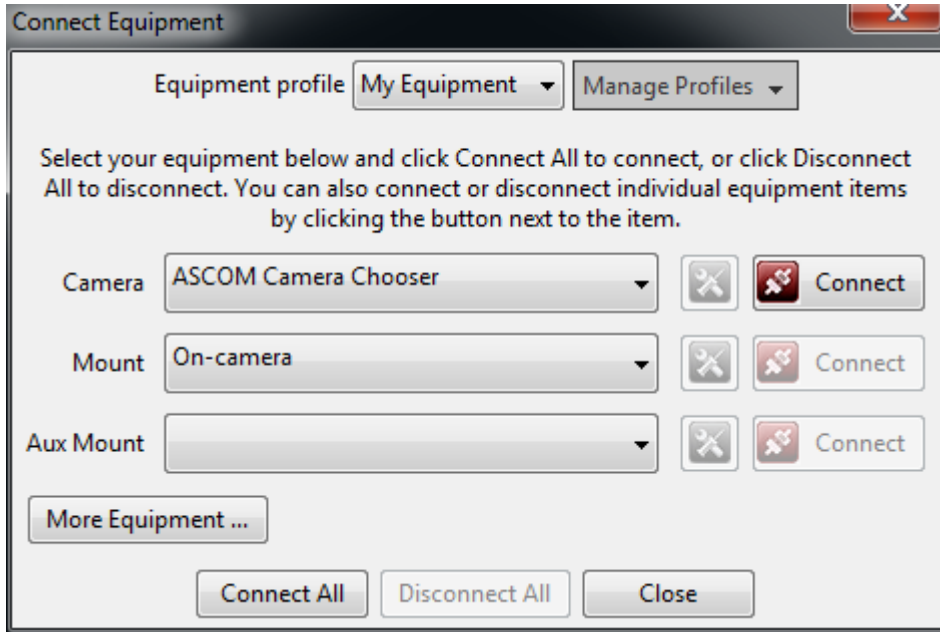
When you change the exposure. CMOS sensor will generate one or more short exposure frame and you may receive this frame. And the next frame will be a normal frame with correct exposure time.



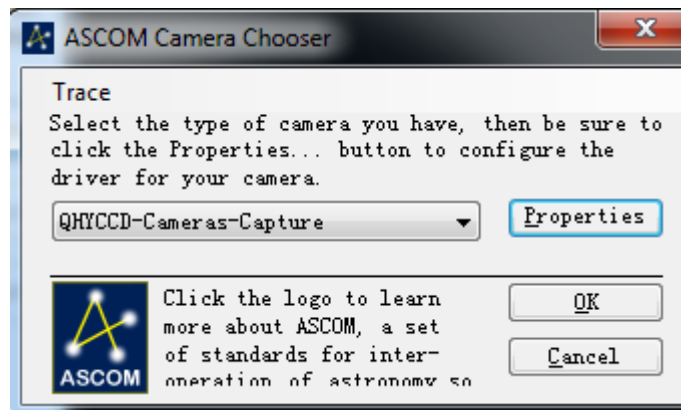
## PHD Guiding

You can use PHD Guiding software and the on-camera guide port of QHY5III Camera. PHDGuiding can connect with QHY5III camera via ASCOM.

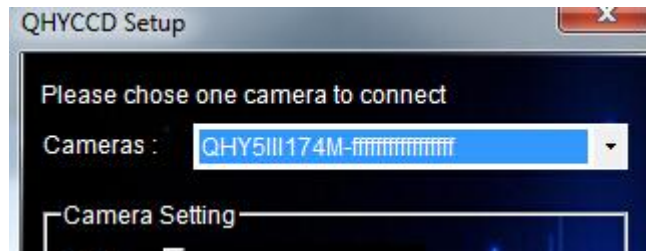
1. In PHDGudiing 2.5. Select ASCOM Camera Choose in Camera and On-camera in mount.



2. Select Connect and In ASCOM camera chooser , select QHYCCD-Camera-Capture




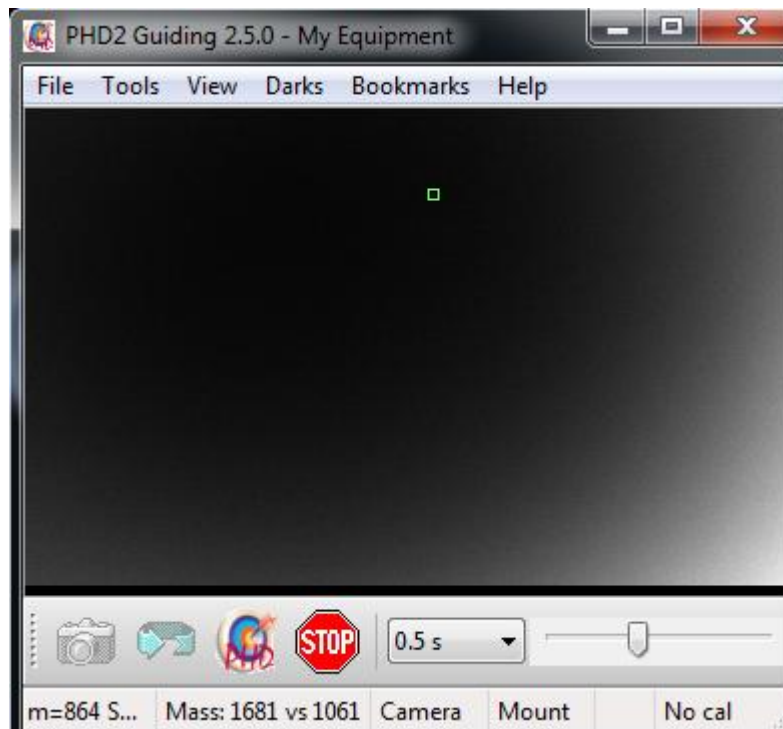
3. In QHYCCD Setup, Select QHY5IIIxxx camera




6. Normally, you can set the gain=1 and offset=10 to start. The speed and overscan calibration options are no using in QHY5III camera.

7. Select "connect all"  to connect the camera and mount

8. Select  button to begin preview.

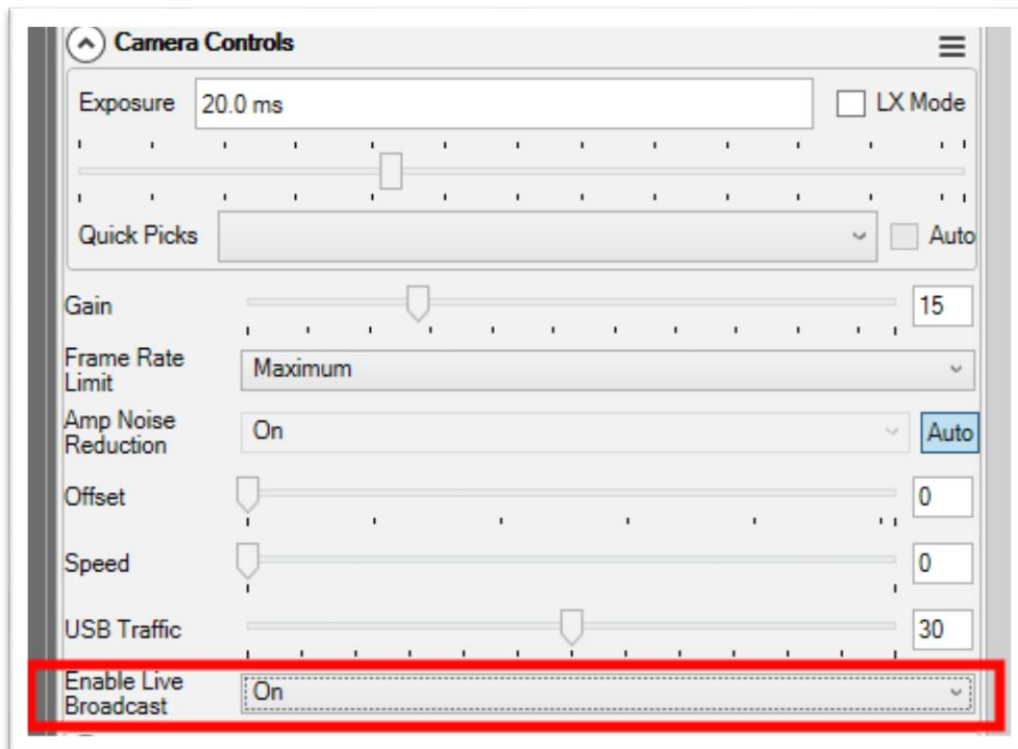


9. Select a star in the screen and click  to start calibration and guiding.

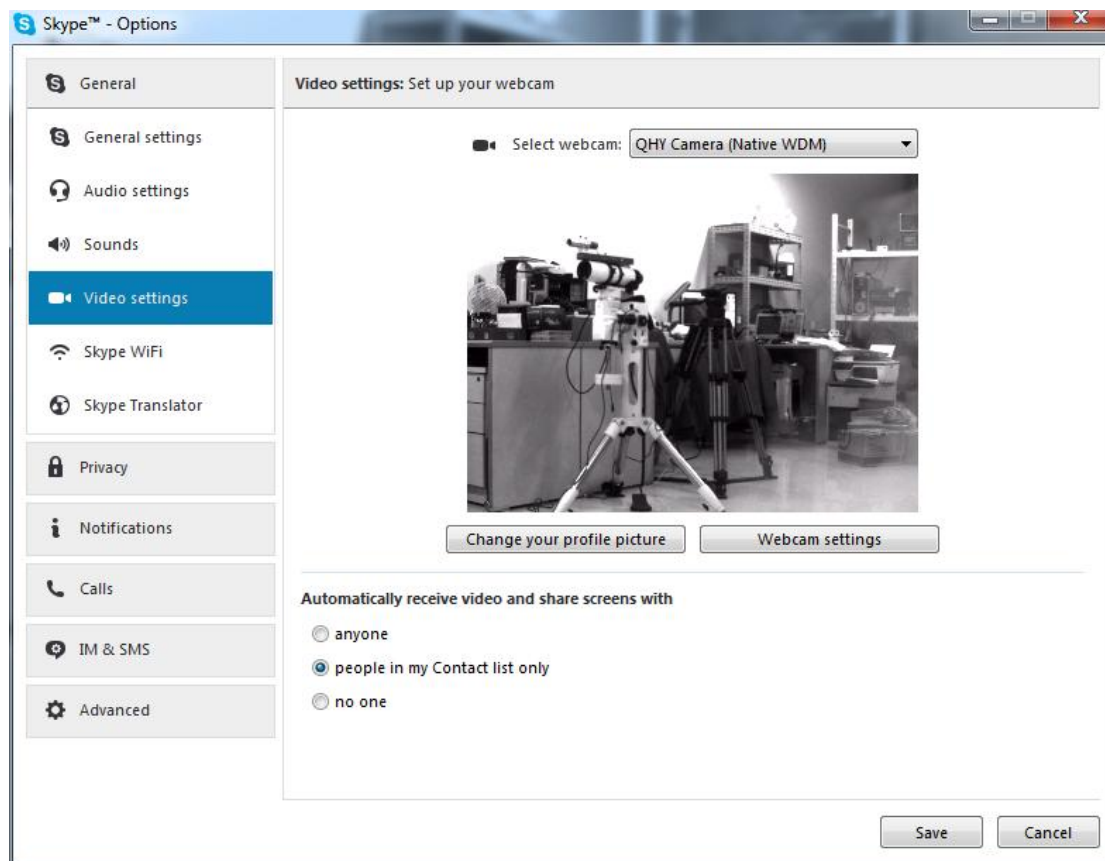
## 05 Use BroadCast Video Streaming

BroadCast video steaming is a special function that QHY5III series cameras support. It can send the video image to multiple target software via QHYCCD BroadCast video driver. For example, you can use the SharpCap software to control QHY5III series cameras and at the same time the video appearing on the SharpCap will be sent to any of software that support the WDM camera, like the HandyAvi, Adobe video encoder, online chat software etc. This function is very useful for the video live broadcast applications.

1. Install the [BroadCast Driver](#)
2. Connect camera to your PC and start SharpCap
3. Turn on “Enable Live Broadcast” at the bottom of Camera Control panel in SharpCap as shown below.

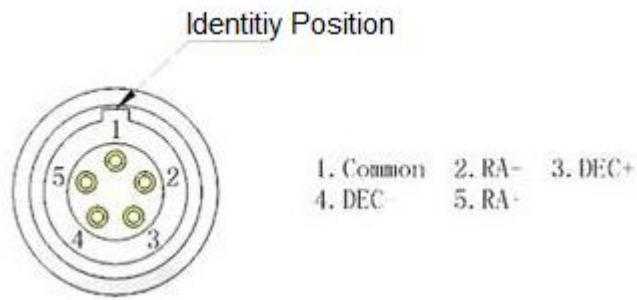


4. Select “QHYCCD camera (WDM)” as your webcam in the software you are using. The camera used in the following example is QHY5III290.





## 06 QHY5III Guide Port Sequence



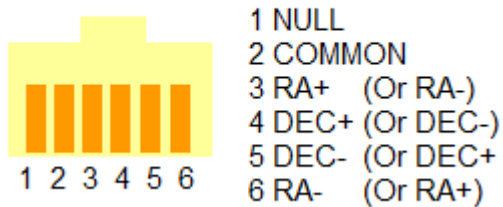
The QHY5III guide circuit has an opto-coupler inside. The “common” pin is normally the GND. Normally the four direction pin of the mount is pulled up by the mount circuit. And when guide pulse comes, the QHY5III will pull down the level on the direction pin.

## 07 QHY5III Guide Port Cable RJ11 Pin Sequence

This connector is fully compatible with the EQ5/EQ6/Celestron/iOptron Guide

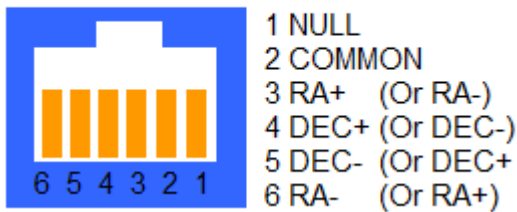
Socket. The Pin Sequence is (When face to the connector of the cable)

Face to QHY5III Guide Cable RJ11 Head



The Socket side (mount side) is

RJ11 Mount Side  
(HEQ5/EQ6/EQ-G) Celestron



If you are using other mount, please check if it is the same pin sequence with the HEQ5/EQ6/Celestron/iOptron.

## 08 FAQs

### 1. Does QHY5III support 12bit or 14bit ?

QHY5III174, 224, 290 support 12bit output and QHY5III178 support 14bit output. All these output is convert to 16bit image to transfer and save. (For 12bit, it is 0-4095 map to 0-65535, for 14bit it is 0-16383 map to 0-65535)

### 2. How to get maximum FPS?

Since QHY5III is very high data bandwidth. Not all computer can get the maximum FPS. Normally I7-4core should no problem for that. The CPU load will also effect the maximum FPS. So please reduce the CPU load by close other applications when using camera. If the CPU load is too high, the software may become very slow or hangs.

### 3. How to avoid the camera hangs?

If your camera always hangs. It may be caused by many reasons. You can check the following things.

3.1 If there is power leak for your mounts and computers? The power leak may cause the leak current transfer from computer to the camera via the GND. This may affect the USB transfer and cause the data packet lost and cause it hang. You need make sure the computer and the mount is well grounded.

3.2 If the USB port's voltage not enough? Some computer's USB port +5V is not enough. It may cause the camera always hangs. In this condition you can use a powered USB3.0 HUB to connect camera and get the good +5V power for camera.

3.3 If your cpu load is too high? If CPU load is too high, it will cause many frame lost and cause the camera hangs. You can increase the USB traffic value to reduce the FPS and get more stable video transfer.

3.4 If the USB cable connection is good enough? Sometimes the contact issue in the USB cable to camera or USB cable to computer will cause the signal loss and cause camera always hangs. Especially when you move the cables. In this condition. You can try to add a little silicon oil into the USB socket/plug .This can increase the contact a lot better.

3.5 Avoid the statics. Sometimes the static electricity on human body will cause the camera hang. You can touch the computer metal case for first before touch the camera to let the static electricity on your body release.

3.6 Some computer's front USB port is not so good for high speed transfer (The reason is it connected to mainboard by a cable and which has no good signal integrity). If you found the camera always hangs on front USB port. You can try the USB port on backside of the computer (which is connect to chipset directly on the mainboard).

#### **4.What's the interface to telescope? How to use C/CS lens on QHY5III**

Because QHY5III camera has 1.25inch eyepiece style design. So it can be intert into the 1.25inch eyepiece tube. No need extra adapter.

QHY5III has the CS thread front part. It can connect with CS lens. The back focal length is 11mm to 11.5mm. Please note this value is a little less than the 12.5mm standard CS back focal length. But you can use the 1.25inch spacer to get it to 12.5mm. The reason that does not design to 12.5mm is to avoid the back focal length is longer than 12.5mm lens and you will no any other method to get the infinine on the imager.

You need select the C or CS lens by the CMOS sensor size. Normally speaking the CS lens only covers 1/3inch sensor size. So QHY5III178 and QHY5III174 can only use the C lens. QHY5III174 may need 1inch C lens. When using the C lens, the backfocal length is 17.5mm, you need buy the C-CS entender to extend 5mm back focal length.

#### **5.How to clean the CMOS sensor and the optic windows of the camera**

If you found there is dust on the cmos sensor. You can screw off the front part of the QHY5III. The SONY CMOS sensor is clear glass and it is no any coating, so that it is quite easy to clean it. You can use the tools that clean the DSLR or just a lens paper to clean it.

The optic window is the IR cut coating or AR coating. So you need to be careful when cleaning it. You can also use the DSLR clean tools or the lens paper. Don't use big force to clean it. The coating is not so hard and it is easy to get scratch when you use big force on it.

#### **6. Does QHY5III working under FireCapture?**

Yes. The lastest FireCapture supports QHY5III already. Please go to FireCapture website to download it.

**7.How about the anti-amplifier functions in QHY5III series**

The different QHY5III models has different behavior under the anti-amp light controllers. The QHY5III174 and QHY5III224 has great improvement under this technology. The QHY5III178 has tiny glow but QHYCCD’s anti-amp light control will reduce it a lot in long exposure time. The QHY5III290 has almost no amplifier light itself.

**8.The debayer sequence of QHY5III color camera in major astronomy software:**

Software	QHY5III174C	QHY5III178C	QHY5III224C	QHY5III290C	QHY5III185C
MAXIMDL					
AstroART					
SGP					
Pixel Insight		GBRG			
The SKYX					

Note1: These is the test results by using 16bit image format

Note2: These is under full size readout, not the ROI.

Note3: These test is based on the software itself. (e.g.: Capture with one software and debayer with the same software)

9. Some vertical noise on the image. Like this



If you found this issue. It should be the wrong driver (native WDM driver) caused. Please update your software to the latest version. You can use the QHYCCD version check tools to check. It

is <http://note.youdao.com/share/?token=79C82E1DC6D34CC4AE603EAB06FB49D2&gid=7234866#/>

### **9. The FPS of cameras sometimes suddenly drops to zero under DDR mode on SharpCap, what's the solution for this problem?**

Recently, we have been told by our users that the FPS of their cameras sometimes suddenly drops to zero under DDR mode on SharpCap. It is caused by the fact that the receiving speed of computer is relatively slower than the sending speed of camera. Once CMOS sensor starts working, it will incessantly conduct exposure and output image data over and over again, and it cannot be interrupted. If USB transmission was interrupted too often by the operating system, the data

overflow of DDR would ensue resulting in bad frame. Therefore, not a single frame is a complete frame, and the FPS will drop to zero.

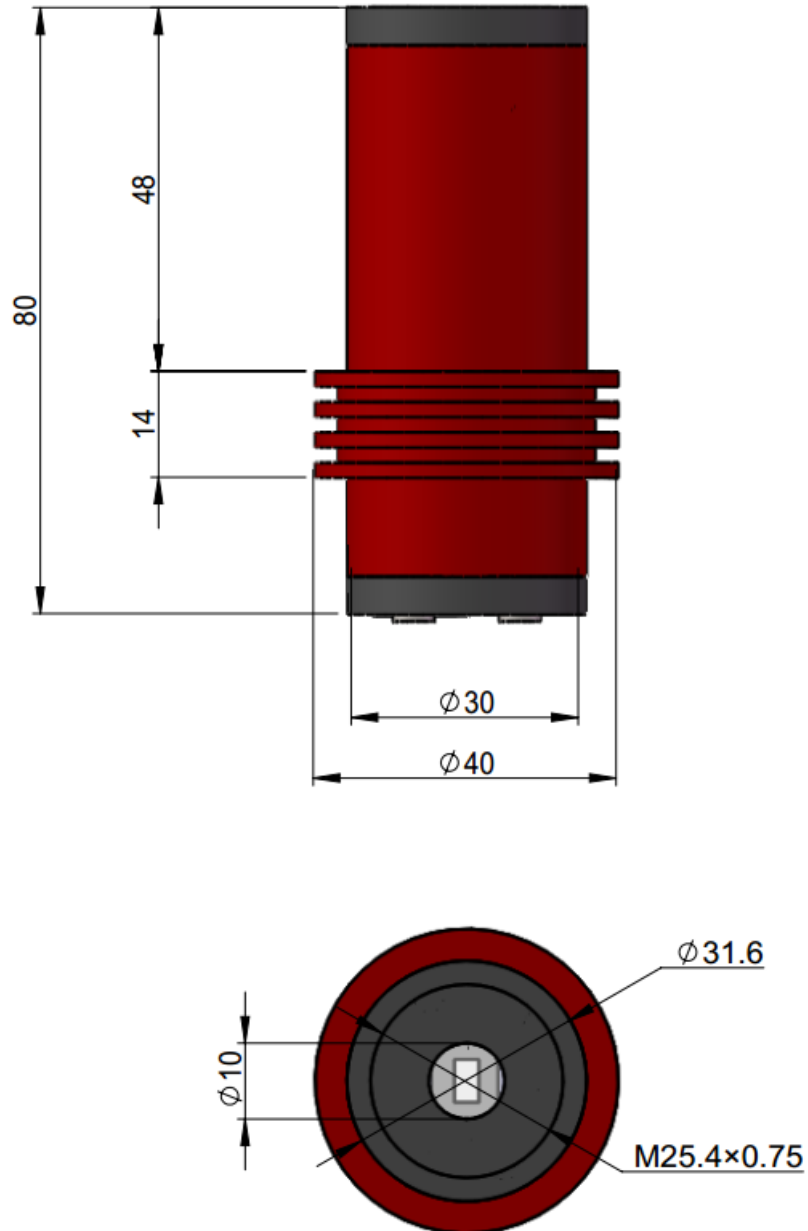
Solutions:

The first solution to this problem is to increase the value of USB traffic to decrease the FPS of the cameras. Note that by using previous version of SharpCap Patch, the value of USB traffic cannot be set to a value large enough, so you should go to our website to download the latest version of SharpCap Patch.

The second solution to this problem is to turn off the DDR mode, but for computers whose performance isn't very good, this solution may not work very well.

## 09 QHY5III Mechanical Size

Front Side (Sensor)



### Back Focal Length

Back focal length of QHY5III series camera is between 10mm-12mm. So that it support both CS mount and C-mount (with a 5mm C-mount extender ring).



## 10 Revision History

<b>Date of change</b>	<b>Revision</b>	<b>Content of change</b>
December 20 <sup>th</sup> , 2016	1.0	First edition
January 5 <sup>th</sup> , 2017	1.1	Add introduction about broadcast application (Section 5).
May 25, 2017	1.2	Added the mechanical dimensions of the screw thread on the front end

# Alberic's short exposure DSO capture

## introduction

Here is a little summary of my technique of short exposures imaging applied to Deep Sky Objects - DSOs. It's a mix between 'Lucky Imaging' technique for planetary objects and long exposure for Deep Sky Objects.

### **Main advantages to use short exposures for DSO are:**

- No need of auto-guiding system which may be difficult to calibrate,
- No need of super heavy, super expensive or super sturdy mounts,
- A 'planetary setup' is enough,
- Shorter exposures = less atmospheric disturbance effects on each frame. So a better resolution can be expected in good or even in medium seeing conditions.

### **Main drawbacks:**

- Few light compared to long exposure so the limit magnitude is lower than traditional long exposure mode. In fact the gap is not as huge as we could expect if adding a lot of frames.

### **What are the limits of 'short exposure'?**

Good question...

For planetary target, limit is Neptune with an Infra-red filter, let's say 0.5 second in worst case. In most cases, less than 100 ms.

For DSOs, few objects (some bright planetary nebulas, open clusters or glubular clusters) could be imaged with 100 to 500 ms exposition time with the most recent sensors.

For galaxies, lower limit exposure time will be 1 second to... 'more'. And 'more' is quickly limited by mount tracking, atmospheric disturbances, wind and dark current of the camera when uncooled. For me a realistic value for 'more' is 5 seconds. So short exposure for DSOs: between 100 ms to 5 sec. As you can see on my first post, for uncooled IMX 174 which have high dark current it's better to decrease the upper limit to 3 seconds.

### **Frames acquisition:**

First, align correctly your mount as done for long exposure.

I currently use a software for planetary/lunar/solar acquisition like SharpCap 2.8 and when it will be released, FireCapture.

Use only 16 bit Image format and save as TIFF or PNG.

Use high gain value: 60 - 90. Higher than 90% will give very noisy frames. Less than 60%, the readout noise will increase.

To reduce the noise pattern that may appear in background of final image, let the target move a little bit on the sensor. With the Hand Pad, or if your mount has a bad Periodic Error curve, it will do the job.

Don't forget to make 'Dark' images after chosen target imaging session, as done for DSO with long exposure. The more frames, the best.

I don't use Bias nor Flat with IMX174. For bigger size sensors I guess that Flat will be necessary.

**Processing:**

Before registration, I manually sort out the good images from the bad ones. I don't use automatic sort out. Of course it takes lot of time but I'm sure it's efficient! You can use automatic process if you prefer.

For registration, I use Registax 5.0 in monopoint mode ('Aligment Method' : 'Default').

Another solution is Autostakkert 2.6 which have optimisation options to reduce horizontal noise pattern like IMX 174.

For post-processing I use Iris and Photoshop to adjust the curves and contrast.

Albéric

see more detail and the picture at <http://qhyccd.com/bbs/index.php?topic=5307.0>